incorporate them into its current beta version of the SM,[505] fail to provide us with any justification to reject the algorithm changes. Indeed, in its reply brief, the only algorithmic or coding change that Verizon identifies as having previously been rejected by the Commission is the PRIM algorithm, discussed above.[506] In contrast to Verizon's lack of specificity in its criticisms, AT&T/WorldCom provide reasonable explanations to support each of their algorithm changes.[507] Accordingly, we accept the AT&T/WorldCom algorithm and coding changes made to the loop module of the MSM.

2. Cost Inputs

a. Updating Cost Input Data

(i) Positions of the Parties

184. In sponsoring the MSM, AT&T/WorldCom propose to update certain data that the Commission adopted in the universal service *Inputs Order*.[508] AT&T/WorldCom use updated data to bring the model forward to reflect, to the extent possible, outside plant costs as of year-end 2002, the middle of their three year-study period.[509] Specifically, AT&T/WorldCom update the line counts, the road distance factor, the feeder structure costs, the DLC input costs, the ARMIS data that underlie the plant mix calculations, and ARMIS financial data that are used in the MSM to calculate outside plant costs.[510]

185. Verizon objects to what it characterizes as selective updating of input data by AT&T/WorldCom.[511] These objections fall into two categories. First, Verizon objects generally to AT&T/WorldCom updating only selected inputs,[512] each of which results in lower costs.[513] For instance, the AT&T/WorldCom proposals to use updated (and higher) line counts (*i.e.*, demand data) and updated ARMIS data that underlie plant mix calculations (which has the effect of reducing the percentage of expensive underground plant deployed) result in the MSM

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[505] Verizon Ex. 108, at 32-33.

[506] Verizon Reply Cost Brief at 135 n.128; *see also supra* section IV(C)(1)(a); AT&T/WorldCom Ex. 14, at 52.

[507] AT&T/WorldCom Ex. 23, Vol. 1 at 3-4; AT&T/WorldCom Ex. 1, at 9, Ex. C at 1-4, 6, 8, Ex. D at 1-6, 8, Attach. 1-6.

[508] AT&T/WorldCom Ex. 1, at 11-13.

[509] *See id.* at 11; AT&T/WorldCom Ex. 23, Vol. 1 at 5-6, Attach. C; AT&T/WorldCom Initial Cost Brief at 33.

[510] AT&T/WorldCom Ex. 1, at 11-13, 18-19; AT&T/WorldCom Ex. 23, Vol. 1 at 8-10, Attach. G; AT&T/WorldCom Initial Cost Brief at 34-36.

[511] Verizon Ex. 109, at 79-83.

[512] *Id.* at 83.

[513] *See* Verizon Ex. 109, at 79-81, 83; Verizon Ex. 108, at 26-33; Verizon Reply Cost Brief at 134-37.

generating loop costs significantly below those generated by the original SM.[514] Verizon estimates that AT&T/WorldCom's proposal to update line counts (the merits of which are addressed below[515]) reduces loop costs by $2.81 per loop per month.[516]

186. Second, Verizon objects to AT&T/WorldCom's proposal to update the line count data without also updating the customer location data.[517] Verizon argues that AT&T/WorldCom's use of projected 2002 line counts with 1997 customer location data causes a significant understatement of loop costs. As a result of this data mismatch, the MSM treats all line growth between 1997 and 2002 as additional (second) lines, producing unattainable economies of scale.[518]

187. Verizon does not propose updating input data to the MSM, except to the extent that Verizon proposes to use data from its cost study in the MSM. For example, in its re-run of the MSM, Verizon proposes to use the fill factors that it uses in the LCAM.[519] For inputs that AT&T/WorldCom do not update, Verizon does not propose specific updates either.

188. AT&T/WorldCom respond to Verizon's contention that it is inappropriate to update select inputs by noting that the Bureau has modified certain input data in the SM to determine universal service support. Specifically, the Bureau has updated line count data without also updating customer location data.[520]

(ii) Discussion

(a) Updating Input Data Generally

189. We find that AT&T/WorldCom may update certain input data without concurrently updating all input data. We reach this conclusion for several reasons. First, adoption of AT&T/WorldCom's proposed updates allows for the use of state-specific data in place of nationwide inputs. When the Commission adopted nationwide inputs in the universal service proceeding, it expressly cautioned that the use of state-specific data may be more

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[514] *See infra* sections IV(C)(2)(a)(ii), IV(C)(2)(b), IV(C)(2)(h).

[515] *See infra* sections IV(C)(2)(a)(ii)(b), IV(C)(2)(b).

[516] Verizon Ex. 108, at 28.

[517] Verizon Ex. 109, at 79-81, 83, 113-17; Verizon Ex. 108, at 29-31; Tr. at 4401-02; Verizon Initial Cost Brief at 154-55.

[518] Verizon Ex. 109, at 83, 116-17; Verizon Ex. 108, at 29-31; Tr. at 4401-02; Verizon Initial Cost Brief at 154-55.

[519] *See* Verizon Ex. 204 (MSM Re-run); *see also infra* section IV(C)(2)(g).

[520] AT&T/WorldCom Initial Cost Brief at 122-23 (citing *Federal-State Joint Board on Universal Service*, CC Docket No. 96-45, Order and Order on Reconsideration, 16 RCC Rcd 22418 (CCB 2001) (*2002 Line Count Order*)); *see* also AT&T/WorldCom Ex. 14, at 60-62.

appropriate for use in determining UNE rates.[521] The purpose of this proceeding is to set UNE prices based on the forward-looking cost of providing those UNEs, thus Virginia-specific data are better suited to this purpose.

190. Second, both Verizon and AT&T/WorldCom propose cost inputs that reflect data of different vintages for different inputs, and both sides update only select inputs in their filings in the arbitration. Indeed, in its cost study, Verizon proposes using updated year 2000 line count data with customer location data from 1993-1995.[522] Similarly, in adopting loop cost inputs for use in the SM, the Commission used data of mixed vintages, including, for example, line count data from 1998, customer locations based on 1997 data applied to 1990 census block data, and DLC investment data from 1995-1998.

191. Third, almost all of the MSM inputs are based on publicly available data. Thus, either side could propose updated inputs without significant difficulty. Verizon had ample opportunity to submit updated data, based either on publicly available data or on its own proprietary data, but it did not do so.[523] Finally, to the extent that complementary data sets reflect different vintages, we analyze the particular data issue below.

(b) Line Count Data

192. We find, based on the options presented by the parties, that it is appropriate to use updated line count data, despite the lack of updated customer location data. Ideally, of course, AT&T/WorldCom would have provided both updated line count data and updated customer location data. Alternatively, Verizon could have submitted updated customer location data. Where, as here, two inputs are used in a single cost equation, we prefer to use recent data of uniform vintage. Neither side, however, submitted such data. Consequently, we must select one of the following options: (1) updated line count data (estimated year-end 2002 vintage) coupled with older customer location data (mid-1997 vintage data applied to 1990 census block data), or (2) older data for both cost inputs (1998 line count data and 1997/1990 customer location data). Between these two options, we adopt the former as more likely to produce forward-looking outside plant costs in Virginia.

193. The Bureau has resolved this exact issue – whether to update line count data without also updating customer location data – in this same manner twice in the context of calculating universal service support. Specifically, in determining support levels for 2001 and 2002, the Bureau issued two separate orders, each of which required the use of updated line

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[521] *Inputs Order*, 14 FCC Rcd at 20172, para. 32 ("it may not be appropriate to use nationwide values for other purposes, such as determining prices for unbundled network elements").

[522] Verizon Ex. 122, at 60; AT&T/WorldCom Ex. 15 (Baranowski Surrebuttal), at 5-6.

[523] AT&T/WorldCom in fact restated many of the inputs that Verizon proposed for its cost models. *See, e.g.*, AT&T/WorldCom Ex. 12, at 19-79, 94-95.

count data even though customer location data were not similarly updated.[524] In these orders, the Bureau concluded that line count data must be updated to reflect cost changes.[525] Static line counts would fail to reflect economies of scale properly, thus violating one of the Commission's forward-looking cost methodology requirements identified in the *Universal Service First Report and Order*.[526]

194. The Bureau also found that the concern that a mismatch between customer location data and line count data would understate costs was exaggerated.[527] The costs for additional lines added at existing locations are accounted for through the line count increase. For example, both the SM and the MSM model larger, more expensive cable sizes to accommodate larger line counts within a cluster. In the line count update orders, the Bureau noted that 72 percent and 65 percent, respectively, of the increase in residential lines nationwide were due to the installation of additional lines at existing locations.[528] The use of road surrogate data to determine customer locations, moreover, means that missing locations lying anywhere on the road network used to create surrogate locations would be reflected in the outside plant structure costs computed by the model. Structure costs would thus be underestimated only to the extent that new locations are along new roads.[529] Further, we note that, although updated line count data are readily available (and reported to the Commission quarterly by the National Exchange Carrier Association (NECA)), updated customer location data are not. This remains the case even after the release of year 2000 Census data because such data do not currently exist in a format that the Commission could use to update customer location data.

195. Finally, we note that Verizon updates line count data but not customer location data in proposing its cost studies. Verizon uses 2000 line count data along with customer

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[524] *2002 Line Count Order*, 16 FCC Rcd at 22418, 22420-22, paras. 1, 6-12; *Federal-State Joint Board on Universal Service*, CC Docket No. 96-45, Order, 15 FCC Rcd 23960, 23964-66, paras. 1, 8-13 (CCB 2000) (*2001 Line Count Order*).

[525] *2002 Line Count Order*, 16 FCC Rcd at 22420-21, para. 7; *2001 Line Count Order*, 15 FCC Rcd at 23964, para. 9.

[526] *2002 Line Count Order*, 16 FCC Rcd at 22420-21, para. 7 (citing *Universal Service First Report and Order*, 12 FCC Rcd at 8915, para. 250(6) ("The cost study or model must estimate the cost of providing service for all businesses and households within a geographic region. This includes the provision of multi-line business services, special access, private lines, and multiple residential lines. Such inclusion of multi-line business services and multiple residential lines will permit the cost study or model to reflect the economies of scale associated with the provision of these services."); *2001 Line Count Order*, 15 FCC Rcd at 23964, para. 9 (citing same).

[527] *2002 Line Count Order*, 16 FCC Rcd at 22421-22, paras. 10-12; *2001 Line Count Order*, 15 FCC Rcd at 23965-66, paras. 12-13.

[528] *2002 Line Count Order*, 16 FCC Rcd at 22421-22, para. 11 n.26; *2001 Line Count Order*, 15 FCC Rcd at 22965, para. 12.

[529] *2002 Line Count Order*, 16 FCC Rcd at 22421-22, para. 11; *2001 Line Count Order*, 15 FCC Rcd at 23965-66, para. 13.

location data from 1993-1995.[530] Thus, Verizon appears to concede implicitly that it is not necessarily inappropriate to use a cost model that uses updated line count data, but not updated customer location data.

b. Loop Count Demand Data

196. Having determined that it is appropriate to consider updated line count data, we must now address the manner in which AT&T/WorldCom propose to determine this input data.

(i) Method for Updating to 2002

(a) Positions of the Parties

197. AT&T/WorldCom propose using an estimated year-end 2002 line count to calculate loop costs. AT&T/WorldCom start with the actual line count for Verizon for the year 2000, as reported by NECA, and then project a growth rate for 2001 and 2002. In so doing, they estimate what the line count would be in the middle of their three-year study period.[531] To project line count growth from year 2000 to 2002, AT&T/WorldCom analyze annual NECA line counts for Verizon from 1994 through 2000 to determine the annual line growth rate for each year. They then apply the average growth rate between 1994 and 2000 to the actual year 2000 line count to calculate an estimate for the 2002 line count.[532]

198. Verizon claims that AT&T/WorldCom's methodology for estimating 2002 line counts is flawed. Specifically, Verizon contends that AT&T/WorldCom ignore both more recent trends in line growth that show that growth is slowing, and factors used by incumbent LECs to develop demand forecasts.[533] Verizon states that the projected growth rates used by AT&T/WorldCom exceed the actual growth realized in 2000 and suggests that, if line counts are to be updated, the growth rates that Verizon experienced in 2000 represent more reasonable alternatives.[534]

(b) Discussion

199. We agree with Verizon that the better way of projecting a 2002 line count is to use

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[530] Verizon Ex. 122, at 60; AT&T/WorldCom Ex. 15, at 5-6.

[531] AT&T/WorldCom Ex. 1, at 11; AT&T/WorldCom Ex. 23, Vol. 1 at 5, Attach. D. In their post-hearing brief, AT&T/WorldCom mischaracterize their line count projections to be to mid-2002, instead of to year-end 2002. *See* AT&T/WorldCom Initial Cost Brief at 121-22.

[532] AT&T/WorldCom Ex. 23, Vol. 1 at 5, Attach. D.

[533] Verizon Ex. 109, at 113-18 (identifying factors such as local economic conditions, requests for building permits, community demographics, and "the life-cycle phase of services").

[534] *Id.* at 113-14.

the actual year 2000 growth rate instead of the 1994 to 2000 average growth rate proposed by AT&T/WorldCom. Although it may be appropriate as a statistical matter to analyze several years' worth of line growth data to determine a trend and then apply this trend to the most recent year's data, as applied here this approach raises several concerns. First, we question the inclusion by AT&T/WorldCom of line count data for two years before the enactment of the 1996 Act. The 1996 Act spurred the development of facilities-based competition, which affects Verizon's line growth, and AT&T/WorldCom did not account for this affect. Second, AT&T/WorldCom calculate an arithmetic average of the years 1994-2000, without attempting to weight growth in individual years in response to changing circumstances. We question whether it is appropriate to weight equally line growth data from the boom years immediately following the 1996 Act and from the year 2000. Indeed, as Verizon notes, line growth slowed considerably in 1999 and 2000 compared to earlier years,[535] and AT&T/WorldCom offer no evidence that the more recent trend would not continue through 2002. We find that the most recent data (*i.e.*, 2000) provide a better basis to predict line growth for the following two years (*i.e.*, 2001 and 2002). Accordingly, we adopt the Verizon proposal and generate projected year-end 2002 line counts by applying the year 2000 line growth rate to the year 2000 line count.[536]

(ii) Using DS-0 Equivalents to Account for DS-1s and DS-3s

(a) Introduction

200. Both the SM and the MSM use as inputs estimates of the number of DS-0 equivalent lines representing residential lines, switched business lines, and special access lines (the latter of which represent primarily DS-1 and DS-3 non-switched business lines).[537] The number of special access lines used by both models is based on the number of high capacity lines (*i.e.*, DS-1 and DS-3 lines) reported by incumbent LECs, in this case Verizon, to the Commission (as part of the ARMIS reporting) on a DS-0 equivalent basis.[538] To determine the number of DS-0 equivalent high capacity lines, the incumbent LECs calculate DS-0 equivalents on a per channel basis. Thus, each DS-1 is counted as 24 DS-0 equivalent channels, and each DS-3 is counted as 672 DS-0 equivalent channels.[539]

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[535] *See id.* at 114.

[536] To determine projected 2002 line counts by wire center, we (1) began with AT&T/WorldCom's proposed 2002 line counts by wire center; (2) reduced these amounts by the growth rates that AT&T/WorldCom applied for 2001 and 2002 to arrive at line counts for year-end 2000; and (3) applied the year 2000 growth rates that we adopt herein to the year 2000 line counts for years 2001 and 2002. We also verified that the year 2000 line counts, in aggregate, are the same as those that Verizon reported in its ARMIS filings.

[537] *See* AT&T/WorldCom Ex. 23, Vol. 1, Attach. D.

[538] *Inputs Order*, 14 FCC Rcd at 20202, para. 100.

[539] *See* ARMIS instructions, available on the Commission's web site at http://www.fcc.gov/wcb/armis/instructions/2002/definitions08.htm#T1Agen (visited Mar. 28, 2003).

201. Based on the line count inputs, including the high capacity DS-0 equivalent counts, the SM and the MSM construct the facilities needed to provide each kind of service. As an end result, the models compute a total cost for each wire center. Using the convention that all high capacity lines are counted in terms of their DS-0 equivalents, the models then calculate the average cost per line by dividing total cost by the number of DS-0 equivalent lines (equal to the sum of residential, switched business, and special access lines) resulting in a rate for a DS-0 equivalent line (*i.e.*, the basic two-wire loop).

202. The SM uses two additional inputs to determine the kind of facilities to build. It assumes that a fixed percentage (equal to 12.75 percent) of switched business lines are carried on either DS-1 or DS-3 facilities and that a different fixed percentage (equal to 91.75 percent) of special access lines are carried on either DS-1 or DS-3 facilities.[540] For all lines carried on DS-1 or DS-3 facilities, there is no change in the amount of fiber feeder capacity used, but the number of twisted copper pairs in both the feeder and distribution portions of the network is assumed to be equal to the number of DS-0 equivalent lines divided by 12 (because 2 pairs can carry 1.5 Mbps or up to 24 DS-0 circuits).[541]

(b) Positions of the Parties

203. As stated, the MSM incorporates high capacity lines through DS-0 equivalent line counts, which assume a 24:1 DS-0 to DS-1 ratio and a 672:1 DS-0 to DS-3 ratio. To determine the costs of DS-1 and DS-3 loops, AT&T/WorldCom propose using cost factors of 4.3:1 and 41.3:1 for DS-1 loops and DS-3 loops, respectively.[542] AT&T/WorldCom implicitly recognize that the use of DS-0 equivalent line counts based on channel capacity in combination with the SM's assumptions regarding the percentage of special access facilities may be inconsistent with the DS-1 and DS-3 cost factors they propose, and that this inconsistency could result in understating loop costs by spreading too few costs over too many DS-0 equivalent loops.[543]

204. To correct for any understatement of total costs, AT&T/WorldCom modify the default inputs of the SM by setting the percentages of switched business lines and special access lines carried on either DS-1 or DS-3 facilities to zero.[544] That is, when the MSM calculations are performed, the model never deploys any DS-1 or DS-3 facilities using the 12:1 line ratio. Instead, the model is instructed to configure the outside plant network such that all lines are

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[540] *See Inputs Order*, 14 FCC Rcd at 20202, para. 100.

[541] *See id.*

[542] As explained, *infra* section IV(D)(1)(c), we adopt the AT&T/WorldCom proposal.

[543] *See* AT&T/WorldCom Ex. 1, at 18, 20-21; AT&T/WorldCom Ex. 14, at 43-46; AT&T/WorldCom Ex. 23, Vol. 1 at 11-12.

[544] AT&T/WorldCom Ex. 1, at 11.

carried on two-wire analog circuits.[545] Thus, although the total number of DS-0 equivalent lines remains overstated, the total network costs are also overstated because the MSM deploys more copper pairs than are actually required.[546]

205. Verizon claims that using DS-0 equivalents to account for high capacity special access lines overstates the number of loops assumed in the network, thereby understating loop costs. Holding costs constant, as the number of loops increases, the cost per loop decreases. Verizon advocates the use of physical per line data, rather than DS-0 equivalents.[547] By not using physical per line data, Verizon contends that AT&T/WorldCom fail to allocate costs properly to DS-0 loops and assume unattainable network efficiencies and economies of scale.[548] If physical per line data are not used for high capacity special access lines, then Verizon alternatively proposes that special access DS-0 equivalents be removed from the MSM computations entirely.[549] All switched business lines should also be assumed to use DS-0 facilities. By making these changes to the MSM, the model would determine costs that reflect achievable economies of scale.[550]

206. To the extent that we accept use of DS-0 equivalents as representative of high capacity special access outside plant lines and costs, Verizon also criticizes AT&T/WorldCom's method of calculating the DS-0 equivalents. Specifically, Verizon claims that AT&T/WorldCom inflate the line counts by misinterpreting Verizon's year 2000 ARMIS data, and understate costs by failing to include investments necessary for DS-1 and DS-3 multiplexing equipment.[551]

207. AT&T/WorldCom admit that they initially misinterpreted the Verizon ARMIS data. They subsequently reduced the number of special access DS-0 equivalents by 700,000 to correct this error.[552] AT&T/WorldCom contend that Verizon's claim that using DS-0 equivalents rather than physical pairs understates costs is actually a matter of cost allocation. Use of DS-0 equivalents allocates more costs to high capacity lines relative to DS-0s than would the use of actual physical per line data. Thus, the use of DS-0 equivalents increases the costs associated with DS-1 and DS-3

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[545] *Id.* at 18; AT&T/WorldCom Ex. 23, Vol. 1 at 11-12.

[546] *See* AT&T/WorldCom Ex. 1, at 18, 25.

[547] *See* Verizon Ex. 109P (Murphy Rebuttal), at 35-37 (confidential version); Tr. at 4517-25.

[548] Verizon Ex. 109P, at 30-38 (confidential version); Verizon Ex. 108, at 29 n.20; Tr. 4395-96, 4487-92, 4517-25; Verizon Initial Cost Brief at 143-45.

[549] *See* Verizon Ex. 109, at 31; Verizon Ex. 162 (Tardiff Supplemental Rebuttal), at 3-6; Verizon Ex. 204; Tr. 4395-96, 4487-92, 4517-25.

[550] *See* Verizon Ex. 109P, at 29-38, 113-17 (confidential version); Verizon Ex. 204; Tr. 4395-96, 4487-92, 4517-25; Verizon Initial Cost Brief at 143-46.

[551] Verizon Ex. 109, at 37.

[552] AT&T/WorldCom Ex. 14, at 72; AT&T/WorldCom Initial Cost Brief at 122.

loops, which offsets any reduction in DS-0 loop costs. Total loop costs, however, are not affected.[553] Finally, AT&T/WorldCom claim that, by accounting for line cards and other costs that are necessary to deploy the number of DS-0 equivalent lines calculated, the model captures sufficient costs to account for DS-1 and DS-3 multiplexing investments.[554]

(c) Discussion

208. We find that counting high capacity (*i.e.*, DS-1 and DS-3) lines on a per channel DS-0 equivalent basis (*i.e.*, 24 DS-0s per DS-1 and 672 DS-0s per DS-3), when combined with the AT&T/WorldCom proposal to determine the cost of DS-1 and DS-3 loops based on different cost ratios (*i.e.*, 4.3:1 DS-1 to DS-0 and 41.3:1 DS-3 to DS-0), creates total cost and cost allocation problems that all but ensure that total outside plant costs are not recovered. Specifically, basing the costs for DS-1 and DS-3 loops in the DS-0 loop cost calculations on one DS-0 equivalency ratio, while basing the cost recovery mechanism for DS-1 and DS-3 loops on a different, lower DS-0 equivalency ratio, results in under-recovery of total outside plant costs.

209. AT&T/WorldCom's proposed solution fails to resolve the total cost and cost allocation problems. AT&T/WorldCom propose to offset overstating line counts, which result from the 24:1 and 672:1 DS-0 equivalent calculations for DS-1 and DS-3 loop facilities, respectively, by overstating the number of facilities on which DS-0 special access (and switched business) lines are carried. Specifically, AT&T/WorldCom propose to assume that DS-0 outside plant will be built to carry all special access (and switched business) lines, thereby overstating the outside plant costs for these lines.[555] They do not, however, offer evidence that the overstatement of costs offsets the overstatement of the DS-0 equivalent line count. Rather, this "two-wrongs-make-a-right" approach does not resolve the total cost problem (except, perhaps, by happenstance).[556]

210. Verizon proposes to address the total cost problem, as well as its allegation that the use of DS-0 equivalents to account for special access lines creates unachievable economies

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[553] *See* AT&T/WorldCom Ex. 14, at 44-47; AT&T/WorldCom Initial Cost Brief at 125.

[554] *See* AT&T/WorldCom Ex. 14, at 48-49.

[555] AT&T/WorldCom Ex. 1, at 18; AT&T/WorldCom Ex. 23, Vol. 1 at 11-12.

[556] We note that, had we accepted the AT&T/WorldCom approach to use DS-0 equivalent line counts for high capacity special access lines, two specific Verizon criticisms would fail to withstand scrutiny. First, AT&T/WorldCom correct their original faulty application of the number of special access lines in Verizon's year 2000 ARMIS data by lowering the number they use in their best and final offer from 2.8 million to 2.1 million. Keffer Dec. 12 Letter, Install A; AT&T/WorldCom Ex. 14, at 72-73. Second, as AT&T/WorldCom state, Verizon misinterprets the DS-0 equivalent calculations that AT&T/WorldCom perform by failing to recognize that AT&T/WorldCom include DLC costs associated with all DS-0 equivalent lines, which captures sufficient costs to account for DS-1 and DS-3 multiplexing investments. *See* AT&T/WorldCom Ex. 14, at 48-49.

of scale,[557] by zeroing out the DS-0 equivalent special access line counts and associated costs in the MSM.[558] We find that this approach, although not ideal, offers a solution consistent with the Commission's arbitration rules.[559] Therefore, we adopt the Verizon proposed solution.

211. In order to implement this proposal, the number of special access lines in each wire center is set equal to zero, with switched business and residential line counts remaining unchanged. In addition, we set the percentages of switched lines carried on DS-1 or DS-3 facilities equal to zero, as both Verizon and AT&T/WorldCom propose (albeit for different reasons).[560] Using the resulting cost estimate to determine the number of and rates for DS-0 lines, rates for DS-1 and DS-3 lines may then be determined using the now independent AT&T/WorldCom proposed DS-1 to DS-0 and DS-3 to DS-0 cost ratios (*i.e.*, 4.3:1 and 41.3:1, respectively). DS-1 and DS-3 loop rates may be based on these (or any other appropriate) cost ratios because the rates for these loops would no longer rely on DS-0 costs that already include high capacity loop costs. That is, using this convention to determine DS-0 loop costs resolves total cost issues between the DS-0 loop costs and the DS-1 and DS-3 loop costs by making the DS-0 loop cost determination independent of the DS-1 and DS-3 loop cost determination.

212. We adopt the Verizon proposed modification as a valid application of TELRIC principles. We acknowledge, however, that the rates computed according to this proposal represent an upper bound on the rates of the basic two-wire analog loop. Because two-wire loops and higher capacity loops share network facilities, the correct economic approach to pricing would be to assign to DS-0 loops their directly attributable incremental costs plus a share of the joint facilities costs of providing DS-0 loops and high capacity loops. The Verizon approach assigns to the DS-0 loops the full stand-alone cost of providing DS-0 loops, which is equal to the directly attributable incremental costs of DS-0 loops plus all of the joint facilities costs of all outside plant. By assigning all of the outside plant joint facilities costs to the DS-0 loop type, the basic 2-wire loop rates are within (but at one end of) the reasonable TELRIC range.

213. The Commission has repeatedly stated in its section 271 orders that the application of TELRIC principles can result in UNE rates that fall within a range of

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[557] Regarding Verizon's proposal to use physical per line data instead of DS-0 equivalent data, we note that no such data have been introduced into the record.

[558] Verizon Ex. 204.

[559] *See supra* section II(C) (discussing the baseball arbitration rules). An ideal solution might involve running the MSM multiple times in order to compute the incremental costs of both DS-0 lines and high capacity lines, as well as the total cost of providing all lines together in the network. Some "reasonable" allocation of the common costs, based on DS-0 equivalent lines or actual facilities could then be imposed. Because we have no record on how to effectuate such reasonable allocations of common costs among different loop types, we have no basis to implement such a solution in this proceeding.

[560] *See* Verizon Ex. 204.

reasonableness; that is, TELRIC does not mandate a specific rate, but rather is a methodology under which rates may result within a reasonable range.[561] Here, we are faced with two proposals for accounting for special access lines and their associated costs. AT&T/WorldCom's proposal would result only by chance in loop rates that fall within the range of reasonableness. Verizon's proposal, in contrast, falls within the reasonable TELRIC range. Accordingly, pursuant to the baseball arbitration rules,[562] we adopt Verizon's proposal because it is the only valid one before us.

(iii) Inclusion of All Wire Centers

(a) Positions of the Parties

214. Verizon criticizes the validity of the MSM because it excludes two Virginia wire centers -- Centreville (CLLI code CNVIVACT) and McLean/Lewinsville (CLLI code MCLNVALV).[563] Verizon characterizes this flaw as an example of the inherent failure of the MSM to model UNEs properly.[564] Verizon makes no specific proposal to adjust the MSM to include these wire centers.

215. AT&T/WorldCom acknowledge that the MSM as originally submitted erroneously excluded these two wire centers.[565] During the course of the arbitration, AT&T/WorldCom corrected this problem, including both of these wire centers in their best and final offer submission.[566]

(b) Discussion

216. We find this issue to be moot. AT&T/WorldCom recognize that they failed to include two Verizon wire centers in their original cost model submission. They then corrected this error in their best and final offer submission. Inasmuch as AT&T/WorldCom respond fully to Verizon's criticism, no disagreement remains for us to resolve.

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[561] *See, e.g., Application by Bell Atlantic New York for Authorization Under Section 271 of the Communications Act to Provide In-Region, InterLATA Service in the State of New York*, CC Docket No. 99-295, Memorandum Opinion and Order, 15 FCC Rcd 3953, 4084, para. 244 (1999) (*New York 271 Order*), *aff'd sub. nom. AT&T Corp. v. FCC*, 220 F.3d 607 (D.C. Cir. 2000).

[562] *See supra* section II(C).

[563] Verizon Ex. 163 (Murphy Supplemental Rebuttal), at 20-23; Verizon Initial Cost Brief at 146 n.149.

[564] Verizon Ex. 163, at 23.

[565] Tr. at 4429-30.

[566] *See* Keffer Dec. 12 Letter, Install A.

c. Customer Location Data

(i) Verifiability of Data

(a) Positions of the Parties

217. To model outside plant costs, a cost model must identify the locations of the end-user customers that are connected to the local network. AT&T/WorldCom use the same customer location data that the Commission used in the SM.[567] Verizon alleges that, because the customer location data utilized by the MSM is based on proprietary third-party (*i.e.*, Taylor Nelson Sofres (TNS)) information, the accuracy and reliability of the data cannot be tested.[568]

(b) Discussion

218. We reject Verizon's assertion and find instead that the AT&T/WorldCom customer location data are sufficiently verifiable for use in a TELRIC model. Although we generally prefer to rely on public rather than proprietary data, in the instant case, all parties had sufficient ability to review and comment on the proprietary-based data. In the *Inputs Order*, the Commission endorsed the use of the PNR (predecessor to TNS) road surrogate algorithm and the PNR methodology for estimating customer location data.[569] Verizon (through its predecessor entities Bell Atlantic and GTE) was able to and did comment on the use of PNR's algorithm and methodology to calculate customer location data.[570] The Commission responded to, and rejected, Verizon's claims there.[571] In particular, the Commission found that "interested parties have been given a reasonable opportunity to review and understand the National Access Line Model process [proposed by PNR] for developing customer counts."[572] Verizon, moreover, fails to propose any alternative source of customer location data for use in the MSM. Accordingly, the customer location data accepted by the Commission in the *Inputs Order* remain the best available source of customer location data, and we find it appropriate for use in the MSM.

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[567] AT&T/WorldCom Ex. 14, at 61.

[568] Verizon Ex. 109, at 118; Verizon Initial Cost Brief at 164.

[569] *Inputs Order*, 14 FCC Rcd at 20176-87, paras. 40-62.

[570] *Federal-State Joint Board on Universal Service*, CC Docket Nos. 96-45, 97-160, Bell Atlantic Inputs Further Notice Comments at 13-15 (filed July 23, 1999), GTE Inputs Further Notice Comments at 37-39 (filed July 23, 1999).

[571] *Inputs Order*, 14 FCC Rcd at 20178-80, 20182-86, paras. 45-47, 54-61 (rejecting Bell Atlantic and GTE criticisms of the PNR algorithm as unverifiable).

[572] *Id.* at 20185-86, para. 60.

(ii) Road Factor

(a) Introduction

219. The MSM, like the SM, uses road surrogate data to estimate customer locations because the more accurate customer geocoded data were not available.[573] In using road surrogate data, the model plots customer locations in each cluster at equal distances apart on the roads modeled. This may not reflect the actual dispersion of customers on roads.

220. A road factor could be used to adjust for any inaccuracies caused by the use of surrogate data. The factor would be less than 1.0 if dispersion and cable and structure counts were overstated and greater than 1.0 if they were understated. In the *Inputs Order*, the Commission rejected using a nationwide road factor of less than 1.0 because parties to the universal service proceeding failed to submit reliable data to verify that the use of road surrogate data overstated customer dispersion.[574]

(b) Positions of the Parties

221. AT&T/WorldCom propose a road factor of 0.9 to compensate for the overstated dispersion and cable and structure counts that result from the use of road layout based surrogate customer location data, as opposed to more accurate geocoded customer location data. AT&T/WorldCom support this change from the 1.0 road factor used in the SM by claiming that: (1) a newer BellSouth Telecommunications, Inc. (BellSouth) cost model based on actual geocoded data generates considerably fewer distribution route miles than does the SM, and (2) a comparison by the Kansas Corporation Commission of actual customer locations to surrogate customer locations showed that the route distances generated by the surrogate locations were fifteen percent too high.[575]

222. Verizon opposes the use of a road factor of less than 1.0. It argues that the Kansas study cited by AT&T/WorldCom is inapplicable because a road factor must be calculated on a state-specific basis.[576] AT&T/WorldCom fail to do so or even to provide any evidence of similarities between customer location data for wire centers in Kansas and in Virginia.[577] Had a study been performed that analyzed ARMIS sheath distances in Virginia, Verizon claims that it would have shown that the road factor should have been greater than 1.0.[578] Verizon, however, does not propose

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[573] *See id.* at 20172-87, paras. 33-62.

[574] *Id.* at 20194-95, paras. 80-82.

[575] AT&T/WorldCom Ex. 1, at 21-22; AT&T/WorldCom Ex. 14, at 59; AT&T/WorldCom Initial Cost Brief at 126-27; AT&T/WorldCom Reply Cost Brief at 49-50.

[576] Verizon Initial Cost Brief at 167; *see also* Verizon Ex. 109, at 103.

[577] *See* Verizon Ex. 109, at 102-03; Verizon Initial Cost Brief at 167-68.

[578] Verizon Ex. 109, at 102-03.

using a higher number, preferring instead to retain the 1.0 road factor. Similarly, Verizon contends that the BellSouth model cited by AT&T/WorldCom is an inappropriate basis on which to establish a Virginia road factor because it does not reflect conditions in Virginia.[579] Finally, Verizon notes that, in the *Inputs Order*, the Commission rejected AT&T/WorldCom's claim that a road factor was necessary to adjust for overstated dispersion and inflated amounts of cable and structure.[580]

223. AT&T/WorldCom criticize Verizon's contention that ARMIS sheath distance data should be used to determine the road factor, claiming that such data are not forward-looking because they are based on embedded plant and ignore the structure sharing that would occur between feeder and distribution plant in a reconstructed network.[581]

(c) Discussion

224. We adopt Verizon's proposal to use a road factor of 1.0. In the universal service proceedings, AT&T/WorldCom proposed, and the Commission rejected, the use of a road factor less than 1.0 due to allegedly overstated dispersion and inflated cable and structure amounts.[582] Although the Commission recognized then that the issues raised by AT&T/WorldCom might justify the application of a road factor less than 1.0, it declined to apply such a factor unless it was supported by specific evidence.[583] AT&T/WorldCom fail to provide any Virginia-specific evidence here. For example, although the Kansas decision cited by AT&T/WorldCom relies on a wire-center-by-wire-center analysis,[584] AT&T/WorldCom present no similar analysis for Virginia. Nor do they provide any evidence showing that wire centers in Virginia have characteristics similar to those in Kansas.[585] The BellSouth study cited by AT&T/WorldCom is similarly unavailing. AT&T/WorldCom did not submit the BellSouth study into evidence, thus it has not been reviewed in this proceeding. Although the Kansas Commission decision and the BellSouth cost study may support the reasonableness of Virginia-specific studies (had any been submitted), standing alone they provide insufficient support for AT&T/WorldCom's proposal.

225. Although Verizon suggests that an appropriate road factor would be greater than

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[579] Verizon Initial Cost Brief at 167; *see also* Verizon Ex. 109, at 102-03.

[580] Verizon Ex. 109, at 101-04; Verizon Initial Cost Brief at 167-68.

[581] AT&T/WorldCom Ex. 14, at 57-59; AT&T/WorldCom Ex. 18P (Riolo Surrebuttal), at 19-20 (confidential version); AT&T/WorldCom Initial Cost Brief at 127.

[582] *Inputs Order*, 14 FCC Rcd at 20178-79, 20195, paras. 45-46, 82.

[583] *Id.* at 20179, para. 46.

[584] *An Investigation into the Kansas Universal Service Fund (KUSF) Mechanism for the Purpose of Modifying the KUSF and Establishing a Cost-Based Fund*, Docket No. 99-FIMT-326-GIT, Order 16: Determining the Kansas-Specific Inputs to the FCC Cost Proxy Model to Establish a Cost-Based Kansas Universal Service Fund at paras. 32-33, 38 (Kansas Commission 1999) (*Kansas Commission USF Order*).

[585] *See* Verizon Ex. 109, at 102-03; Verizon Initial Cost Brief at 167.

1.0,[586] it neither proposes such a factor nor provides any evidence to support a higher figure. Rather, Verizon proposes use of the 1.0 factor adopted by the Commission in the *Inputs Order*.[587]

226. We therefore reject AT&T/WorldCom's proposed road factor of 0.9 in favor of the 1.0 factor proposed by Verizon and adopted by the Commission in the *Inputs Order*.

(iii) Vacant Residential and Business Units

(a) Positions of the Parties

227. Verizon claims that customer locations are undercounted by the MSM because the model fails to account for vacant residential and business units. Such units should be included because they represent planned growth, and any LEC (incumbent or competitive) building a network would build to all housing units, not just the ones then occupied.[588] Although Verizon provides some census figures pertaining to the percentage of housing units that were unoccupied in 2000,[589] it does not propose any specific adjustment to the MSM.

228. AT&T/WorldCom contend that the MSM does not undercount customer locations by failing to account for vacant residential and business units.[590] Rather, the Commission explicitly chose to use data based on households rather than housing units in calculating the number of customer locations in the original SM.[591]

(b) Discussion

229. We agree with AT&T/WorldCom that it is appropriate to base customer locations in the MSM on the number of households rather than on the number of housing units. The Commission expressly addressed this issue in the *Inputs Order* and chose to base customer location data on the number of households rather than on the number of housing units in order to achieve consistency in its calculations by avoiding the use of mismatched data.[592] Specifically, the Commission found that vacant units must either be included in both the line count data and the customer location data or in neither. Because line count data, in turn, uses household rather than housing unit data, the Commission found that household data must also be used to determine

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[586] Verizon Ex. 109, at 103.

[587] *See* Verizon Initial Cost Brief at 167-68.

[588] Verizon Ex. 109, at 23; Verizon Initial Cost Brief at 164-65.

[589] *See* Verizon Ex. 109, at 23.

[590] *See* AT&T/WorldCom Ex. 14, at 42-43; AT&T/WorldCom Initial Cost Brief at 145-46 n.135.

[591] AT&T/WorldCom Initial Cost Brief at 145-46 n.135 (citing *Inputs Order*, 14 FCC Rcd at 20183-84, paras. 56-57).

[592] *Inputs Order*, 14 FCC Rcd at 20183-84, paras. 56-57.

customer locations.[593] To use housing units (including vacant units) to determine customer locations would result in inflated line costs due to a data mismatch. Indeed, the Commission specifically found that "adopting housing units as the standard would inflate the cost per line by using the highest possible numerator (all occupied and unoccupied housing units) and dividing by the lowest possible denominator (the number of customers with telephones)."[594] Maintaining consistency in this calculation remains as important here as it was in the universal service proceeding.[595] Thus, because households rather than housing units are used to determine loop counts, households should also be used to determine customer locations.[596] We therefore reject Verizon's proposal to include vacant units in the customer location data only.

d. Cable Drop Length

(i) Positions of the Parties

230. Verizon claims that the drop length used in the MSM is too low and improperly calculated.[597] Specifically, it claims that the MSM uses an inappropriately short drop length of approximately 24 or 27 feet,[598] much shorter than the national average drop length of 73 feet.[599] Verizon largely attributes this error to AT&T/WorldCom's calculation of drop length using the number of drops, rather than the number of lines.[600] Verizon also asserts that the small drop length derives from AT&T/WorldCom's use of an improper road factor and an excessive loop count.[601]

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[593] *Id.*

[594] *Id.* at 20184, para. 57.

[595] The issue of maintaining consistency between data points here is noticeably different from the data mismatch issue we address between line count data and customer location data. *See supra* section IV(C)(2)(a)(ii)(b). Here, the AT&T/WorldCom proposal properly matches both data type (*e.g.*, household v. housing unit) and vintage (*i.e.*, year). Verizon proposes, in concept, that we should mismatch the type of data. In addressing the line count and customer location data issue, we resolved issues of data vintage, not data type. We also found that the possible mismatch is overstated because many new customers will be located at existing customer locations or along modeled plant routes. *See id.* The Bureau, moreover, twice endorsed this approach to line count and customer location data, whereas the Commission expressly determined that no mismatch should exist in the type of data addressed here. *Compare 2002 Line Count Order*, 16 FCC Rcd at 22418, 22420-22, paras. 1, 7-12 *and 2001 Line Count Order*, 15 FCC Rcd 23960, 23964-66, paras. 1, 9-13, *with Inputs Order*, 14 FCC Rcd at 20184-85, para 57.

[596] We also note that Verizon does not offer any explanation as to why any undercount in vacant units is not accounted for through the application of fill factors. *See infra* section IV(C)(2)(g).

[597] Verizon Ex. 109, at 104-07; Verizon Reply Cost Brief at 158.

[598] *Compare* Verizon Ex. 109, at 105 (23.8 feet), *with* Verizon Reply Cost Brief at 157-58 (27.3 feet).

[599] Verizon Ex. 109, at 105 (citation omitted); Verizon Reply Cost Brief at 158.

[600] Verizon Reply Cost Brief at 158.

[601] Verizon Ex. 109, at 104-07; Verizon Reply Cost Brief at 158.

231. AT&T/WorldCom assert that Verizon's criticisms are misplaced. Cable drop lengths should be calculated based on the number of drops, not the number of lines. When properly calculated, the drop length is 77.4 feet, not the 24 or 27 feet that Verizon alleges and longer than the 73 feet that Verizon claims would be appropriate.[602]

(ii) Discussion

232. We agree with AT&T/WorldCom. Drop lengths represent the cable length between the customer location and the drop (*e.g.*, pole, pedestal). Drop lengths should be calculated based on the number of drops, as AT&T/WorldCom propose, not the number of lines.[603] AT&T/WorldCom, moreover, demonstrate that the drop length they use in the MSM is actually longer than the drop length that Verizon proposes as a reasonable alternative.[604]

e. Distribution Length and Engineering Standards for Sizing Distribution Areas

(i) Positions of the Parties

233. Once customer locations have been identified, they must be grouped by the cost model in an efficient and technologically reasonable manner.[605] Two possible ways to group customer locations are use of a clustering algorithm or a grid-based approach.[606] A clustering algorithm uses a multifaceted approach, including the use of internal optimization algorithms, to group locations in proximity to one another into clusters in a manner designed to minimize costs while maintaining a specified level of service quality.[607] Accordingly, in the *Platform Order*, the Commission found the use of a clustering algorithm "consistent with actual, efficient network design."[608] A grid-based approach, as the term suggests, involves grouping customer locations by placing a uniform grid over the area being modeled and grouping together locations that fall within a grid.[609] In comparing these two approaches, the Commission found that, although the grid-based approach is simpler to implement, the use of the clustering algorithm was superior because it identifies "natural groupings of customers . . . does not impose arbitrary serving area boundaries" as

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602 AT&T/WorldCom Ex. 14, at 39-40; AT&T/WorldCom Initial Cost Brief at 184.

603 We address issues raised by Verizon pertaining to the road factor and to the loop count *supra* in sections IV(C)(2)(d)(ii) and IV(C)(2)(b), respectively.

604 *See* AT&T/WorldCom Ex. 14, at 39-40; AT&T/WorldCom Initial Cost Brief at 184.

605 *Platform Order*, 13 FCC Rcd at 21341, para. 42; AT&T/WorldCom Ex. 23, Vol. 1, Attach. B at 4-5.

606 *See Platform Order*, 13 FCC Rcd at 21341-42, para. 43.

607 *Id.* at 21341-45, paras. 43-53; AT&T/WorldCom Ex. 23, Vol. 1, Attach. B at 4-16.

608 *Platform Order*, 13 FCC Rcd at 21342, para. 44.

609 *Id.* at 21342-43, para. 46.

does a grid-based approach, and takes into account engineering constraints such as distance limitations between customer locations and DLC systems.[610]

234. AT&T/WorldCom use the same clustering algorithm in the MSM that the Commission adopted in the SM.[611] In applying this algorithm, the MSM assumes a relatively small number of relatively large clusters, thereby lowering fixed costs while increasing variable (*i.e.*, cable and structure) costs.[612] AT&T/WorldCom also claim that the appropriate copper/fiber break point in the clustering algorithm should be 18,000 feet.[613]

235. Verizon claims that the MSM improperly builds too few DAs with excessively long distribution lengths,[614] and that it fails to follow Carrier Serving Area (CSA) rules, which specify a copper/fiber break point of 12,000 feet.[615] Verizon also contends that the MSM improperly assumes that the number of clusters should be kept small as opposed to minimizing the distribution length per cluster.[616] Finally, Verizon asserts that the MSM routinely models clusters that violate the deployment guideline (different from the CSA rules) that DAs should have between 200 and 600 lines.[617] Verizon claims that, as a result of these errors, the MSM models approximately half of the DAs that actually exist in Verizon's network in Virginia.[618]

236. In response to these criticisms, AT&T/WorldCom claim that Verizon's LCAM model suffers the same infirmities that Verizon identifies in the MSM. Specifically, AT&T/WorldCom allege that the LCAM includes almost 2,500 fewer DAs than does Verizon's actual network in Virginia and that more than twenty percent of the DAs included in the LCAM contain more than 600 working lines.[619] The 200-600 working lines assumption for sizing DAs, moreover, represents a flexible engineering guideline, not a mandatory outside plant design rule.[620]

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[610] *Id.* at 21342-43, 21345, paras. 45-46, 53.

[611] *See* AT&T/WorldCom Ex. 1, at 1, 6-8; AT&T/WorldCom Ex. 23, Vol. 1, Attach. B at 4-16.

[612] AT&T/WorldCom Ex. 23, Vol. 1, Attach. B at 5-7.

[613] AT&T/WorldCom Ex. 18 (Riolo Surrebuttal), at 2-5; AT&T/WorldCom Initial Cost Brief at 127-30; AT&T/WorldCom Reply Cost Brief at 50.

[614] Verizon Ex. 109, at 20-22, 24-25, 27-28; Verizon Initial Cost Brief at 166; Verizon Reply Cost Brief at 143-44.

[615] Verizon Ex. 109, at 19-22, Attach. 2; Verizon Initial Cost Brief at 166; Verizon Reply Cost Brief at 142-43.

[616] Verizon Ex. 109, at 24; Verizon Reply Cost Brief at 143-44.

[617] Verizon Ex. 109, at 20-22; Verizon Reply Cost Brief at 143-44.

[618] Verizon Ex. 109, at 20-22; Verizon Reply Cost Brief at 143-44.

[619] AT&T/WorldCom Ex. 15, at 3-4.

[620] AT&T/WorldCom Ex. 18, at 6.

(ii) Discussion

237. We agree with AT&T/WorldCom and find that the MSM does not improperly size DAs.[621] AT&T/WorldCom persuasively demonstrate that DAs need not always contain between 200 and 600 working lines. Rather, these are general deployment goals.[622] Verizon claims that the Commission limited use of the clustering algorithm of the SM to rural areas and that there is no evidence that the algorithm produces overall efficient results.[623] Moreover, Verizon claims that AT&T/WorldCom misstate the Commission's findings in the *Platform Order*. The SM's documentation, however, notes that the clustering algorithm, which produces a smaller number of larger clusters, will perform better in rural areas than a clustering algorithm focused on generating a larger number of smaller clusters, but that "it is not clear, *a priori*, what number of clusters will embody an optimal trade-off between these fixed and variable costs."[624] The Commission applied optimization routines to its clustering algorithm to reduce the total distance between the customer locations and their clusters' centers by ten to thirty percent, typically.[625] Thus, the Commission found that the SM's clustering algorithm, which is used by the MSM, "provides the least-cost, most-efficient method of grouping customers into serving areas."[626] Accordingly, we find appropriate the use of this clustering algorithm in the MSM.

f. Engineering Standards for Copper Loop Lengths

(i) Positions of the Parties

238. AT&T/WorldCom assign a maximum copper/fiber breakpoint of 18,000 feet in the MSM.[627] They claim that this is consistent with modern CSA outside plant design guidelines and that the Commission endorsed the use of an 18,000 foot break point in the *Platform Order*.[628]

239. Verizon claims that the proper break point should be 12,000 feet and that this

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[621] We discuss the copper/fiber break point issue *infra* in section IV(C)(2)(f). Because we agree with Verizon on that issue, our finding on that issue will affect the average distributions length by reconfiguring in the MSM any loops that originally were determined to have distribution lengths of between 12,000 and 18,000 feet.

[622] AT&T/WorldCom Ex. 15, at 3-4.

[623] Verizon Reply Cost Brief at 144 n. 139.

[624] AT&T/WorldCom Ex. 23, Vol. 1, Attach. B at 5 (emphasis in original).

[625] *Id.*, Vol. 1, Attach. B at 6.

[626] *Platform Order*, 13 FCC Rcd at 21345, para. 53.

[627] AT&T/WorldCom Ex. 18, at 2-5; AT&T/WorldCom Initial Cost Brief at 127-30; AT&T/WorldCom Reply Cost Brief at 50.

[628] AT&T/WorldCom Ex. 14, at 33 (citing *Platform Order*, 13 FCC Rcd at 21352-53, para. 70); AT&T/WorldCom Ex. 18, at 3 (citing same).

limitation is required generally under the CSA guidelines. In particular, the 12,000 foot limit is necessary for a network to provide advanced services and network elements that were not at issue in the universal service proceedings. By using 18,000 feet in the *Platform Order*, Verizon alleges that the Commission departed from CSA guidelines.[629]

240. AT&T/WorldCom respond that the choice of an 18,000 foot or a 12,000 foot break point in the MSM is largely meaningless because fewer than one percent of loops modeled in the MSM have a break point of between 12,000 and 18,000 feet.[630]

(ii) Discussion

241. We agree with Verizon and find that the appropriate copper/fiber break point for use in the MSM is 12,000 feet. CSA guidelines expressly call for a copper/fiber break point at 12,000 feet, not 18,000 feet.[631] The CSA guidelines, although flexible enough to permit some exceptions, are nonetheless the most recent guidelines for building outside plant and, therefore, represent the most appropriate design guidelines to be used in a TELRIC model. Although AT&T/WorldCom note that the Commission used an 18,000 foot break point in the SM,[632] this is not dispositive here. Rather, Verizon is correct that the Commission made that decision in the context of modeling a network designed to provide a basic level of voice service to be supported.[633] Specifically, the Commission found that a design standard that included transmission standards applicable for voice, data, video, sensor control, and other uses exceeded the service quality standards for universal service. The Commission further found that it was not in the public interest to burden the universal service support mechanisms with the costs necessary to support a network capable of delivering very advanced services. Because such a limited network was being modeled, the Commission found an 18,000 feet break point appropriate.[634]

242. This is a different case. Unlike in the universal service context, the functionality of an unbundled loop is not limited to voice-grade service.[635] Thus, the universe of UNE loops included in the loop cost model is broader than the loops in the network modeled only for universal service purposes. When including this broader universe of loops, we conclude that the loop cost model should design outside plant that adheres to CSA guidelines. We therefore apply a

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[629] Verizon Ex. 109, at 19-22, Attach. 2; Verizon Initial Cost Brief at 166; Verizon Reply Cost Brief at 142-43.

[630] AT&T/WorldCom Ex. 14, at 32.

[631] AT&T Ex. 122 (Telcordia Notes on the Network, Section 12), § 12.1.4.

[632] *See* AT&T/WorldCom Ex. 14, at 33 (citing *Platform Order*, 13 FCC Rcd at 21352-53, para. 70); AT&T/WorldCom Ex. 18, at 3 (citing same).

[633] Verizon Ex. 109, at 19, 21; Verizon Reply Cost Brief at 142-43.

[634] *Platform Order*, 13 FCC Rcd at 21352-53, para. 70.

[635] 47 C.F.R. § 51.319(a)(1).

copper/fiber break point of 12,000 feet in the MSM.

g. Fill Factors

(i) Purpose and Use in Cost Models

243. Fill factors represent the percentage of total usable capacity of a part of outside plant (*e.g.*, distribution cable, copper feeder cable) that is expected to be used to meet a measure of demand.[636] Fill factors are used in designing outside plant to ensure that the plant can accommodate existing demand, growth, churn, and administrative functions (such as testing and repair), but also to avoid building excess capacity.[637] In developing a cost model, fill factors that are too low model an outside plant network with excess capacity above that of an efficient firm, thereby leading to inappropriately high UNE loop rates. Conversely, if fill factors are too high, the outside plant designed would be insufficient to support predicted growth and service outages, and the resulting UNE loop rates would be correspondingly too low.[638] In its section 271 orders, the Commission has accepted a wide range of fill factors as consistent with TELRIC principles.[639] Here, consistent with baseball arbitration rules,[640] we adopt the fill factors proposed by one side that are most consistent with Commission rules and precedent.

(a) Positions of the Parties

244. AT&T/WorldCom and Verizon employ different types of fill factors in their respective cost models. AT&T/WorldCom use target fill factors in the MSM, which are designed to approximate the excess capacity a firm would deploy to account for growth, churn, and administrative services over a reasonably foreseeable period of time. Thus, AT&T/WorldCom's proposed fill factors, which vary in the MSM for different parts of outside plant (*e.g.*, distribution, copper feeder, fiber feeder) and for density zones, are intended to ensure that the network models not only the capacity needed to provide service to current customers, but sufficient capacity to provide

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[636] Fill factors are sometimes referred to as utilization factors or utilization rates. *See* Verizon Ex. 109, at 84.

[637] *See Inputs Order*, 14 FCC Rcd at 20237-38, para. 186.

[638] *Id.*

[639] *See, e.g., Joint Application by BellSouth Corporation, BellSouth Telecommunications, Inc., and BellSouth Long Distance for Provision of In-Region, InterLATA Services in Georgia and Louisiana*, CC Docket No. 02-35, Memorandum Opinion and Order, 17 FCC Rcd 9018, 6053, 9054-55, paras. 66, 70 (2002) (allowed use of 69.5 percent for copper feeder, 74 percent for fiber feeder, and 48 percent for distribution as not clear TELRIC error) (*Georgia/Louisiana 271 Order*); *Kansas/Oklahoma 271 Order*, 16 FCC Rcd at 6275-76, para. 80 (30 percent distribution fill factor violates TELRIC as too low); *Application of Verizon New England Inc., Bell Atlantic Communications, Inc. (d/b/a Verizon Long Distance), NYNEX Long Distance Company (d/b/a Verizon Enterprise Solutions) and Verizon Global Networks Inc., for Authorization to Provide In-Region, InterLATA Services in Massachusetts*, CC Docket 01-9, Memorandum Opinion and Order, 16 FCC Rcd 8988, 9007-08, paras. 39-40 (2001) (*Massachusetts 271 Order*) (40 percent distribution fill factor may be too low).

[640] *See supra* section II(C).

for growth, churn, and administrative functions as well.[641] In so doing, AT&T/WorldCom rely on current demand, as opposed to ultimate demand (*i.e.*, the total anticipated future demand).[642] Thus, the fill factors drive the engineering used to model the network capacity.

245. This is the same approach to fill factors that the Commission adopted in the *Inputs Order*, and, for the factors adopted in the *Inputs Order* – distribution, copper feeder, and fiber feeder – AT&T/WorldCom propose using the same fill factors.[643] For remote terminal (RT) plug-in equipment and RT common electronics, AT&T/WorldCom propose using the same fill factors that the Commission adopted for copper feeder in the *Inputs Order*.[644]

246. Verizon does not use target fill factors in its loop cost study. Rather, it uses a capacity modeling approach based on realized (or actual) fill factors.[645] Verizon's engineering guidelines specify that the network should be built to support a certain level of capacity (generally, two lines per customer location). Verizon then applies a fill factor on top of this amount for cost study purposes. In so doing, Verizon applies its fill factor to ultimate demand – total demand for which the network is built – rather than to current demand. In other words, Verizon does not use fill factors to size facilities or otherwise plan the network. Instead, it applies fill factors to the network it will build in order to ensure that "the rates spread the forward-looking costs across only those units of capacity that will be available to produce revenue."[646] Verizon claims that it is being conservative in advocating use of its actual experienced fill factors, in both its cost study and the MSM, because the average fill factor in the competitive environment assumed under TELRIC would be less than its current actual fill due to increased fluctuations in demand and customer churn.[647]

(b) Discussion

247. As we explain in more detail below in the analyses of the individual fill factors, we adopt the fill factors proposed by AT&T/WorldCom. Their proposals comport with the Commission's treatment of fill factors in the *Inputs Order*, in both concept and level.[648] In that order, the Commission expressly adopted use of current demand, rather than ultimate demand, in applying fill factors. Moreover, the Commission rejected GTE's claims, raised again by Verizon

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641 *See* AT&T/WorldCom Initial Cost Brief at 145; *see also* Verizon Ex. 109, at 84.

642 *See Inputs Order*, 14 FCC Rcd at 20239, para. 188 (discussing ultimate demand).

643 *See* AT&T/WorldCom Initial Cost Brief at 151, 157, 160.

644 *See* AT&T/WorldCom Initial Cost Brief at 162-63.

645 Verizon Ex. 107P, at 34-40, 100-16 (confidential version); Verizon Initial Cost Brief at 103-05.

646 *See* Verizon Initial Cost Brief at 103.

647 *See id.* at 105.

648 *See Inputs Order*, 14 FCC Rcd at 20237-38, 20243-44, paras. 186, 200-01.

here, that current demand would not take into account growth. To the contrary, the Commission found that current demand accounts for growth.[649]

248. In addition, because AT&T/WorldCom and Verizon use distinct types of fill factors in their respective models (target fill versus realized fill), the factors used in one model may not be directly substituted into the other model. This is one of the few matters on which AT&T/WorldCom and Verizon agree.[650] Indeed, one Verizon witness, agreeing with an AT&T/WorldCom witness, stated that "there is not a really direct way to know the comparison between our [Verizon's] fill factor and theirs [AT&T/WorldCom's]. . . . It's really a totally different use of the utilization [*i.e.*, fill] factor."[651]

249. Further, in its brief, Verizon defends the use of actual fill factors on the ground that the average fill factor in the competitive environment assumed under the Commission's TELRIC rules would be less than its current actual fill due to increased fluctuations in demand and customer churn.[652] Although there may be some merit to Verizon's argument that competition will lead to greater fluctuations in demand, it also may be the case that companies in a competitive market would develop more efficient mechanisms to respond to these fluctuations (*e.g.*, more creative marketing and pricing strategies, more flexible network architectures). Because Verizon has presented no evidence on this point, we have no basis for finding that there is a negative correlation between competition and outside plant utilization rates.[653]

(ii) Distribution Fill Factor

(a) Positions of the Parties

250. In the MSM, AT&T/WorldCom use target fill factors for distribution cable of between 50 and 75 percent, with an effective fill averaged across density zones of 52.5 percent.[654] These target fills are the same fill factors that the Commission adopted in the *Inputs Order*.[655] To determine the effective fill factor using current demand (as AT&T/WorldCom project it), AT&T/WorldCom perform a test using mid-2001 data for total demand. Specifically, they compute an effective fill factor by comparing the number of cable pairs actually deployed by the model with

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[649] *Id.* at 20243-44, para. 201 ("Significantly, we note that, contrary to GTE's inference, current demand as we define it includes an amount of excess capacity to accommodate short-term growth.").

[650] Tr. at 4494-96.

[651] *Id.*

[652] *See* Verizon Initial Cost Brief at 105.

[653] The effect of increases in risk due to demand fluctuations and churn may be reflected in the cost of capital. *See supra* section III(C).

[654] AT&T/WorldCom Ex. 14, at 13-14; AT&T/WorldCom Initial Cost Brief at 151.

[655] *Inputs Order*, 14 FCC Rcd at 20369, App. A.

the demand number in the model.[656]

251. Verizon claims that AT&T/WorldCom's proposed fill factors would not enable a carrier to operate efficiently and meet minimum service quality standards.[657] Rather, normal network planning requires building two lines to each customer premises to serve ultimate demand.[658] Verizon asserts that although the Commission previously supported use of current, rather than ultimate, demand, this was in the universal service context.[659] By building only to current demand, Verizon contends that AT&T/WorldCom fail to account for demand fluctuations, churn, and administrative functions. Building to ultimate demand also avoids the future costs of inefficient piecemeal deployment.[660] Further, Verizon notes that AT&T/WorldCom's use of 2001 demand data to determine the effective fill factor is inconsistent with other aspects of the MSM that use mid-2002 demand data.[661]

252. Although Verizon criticizes modeling based on current demand rather than ultimate demand, AT&T/WorldCom note that Verizon does not propose an alternative figure (other than that Verizon uses in its own study) for use in the MSM.[662] Nor does Verizon provide any substantiation for its claim that a network built using AT&T/WorldCom's distribution fill factors would have insufficient capacity to function properly. AT&T/WorldCom claim, however, that their proposed fill factors are consistent with GTE engineering guidelines.[663] Verizon further failed to recognize that current demand includes capacity for short term growth, churn, and administrative functions.[664]

253. Finally, AT&T/WorldCom assert that Verizon's claim of a data mismatch between their effective fill factor calculations and their line count data is misplaced. To calculate fill factors, the same point in time must be used for both total available lines and total current lines. AT&T/WorldCom use mid-2001 data for both data points in their effective fill factor test calculation. Using 2002 data for only the numerator (*i.e.*, usable capacity) would improperly inflate

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656 *See* AT&T/WorldCom Ex. 14, at 14 n.16.

657 Verizon Ex. 109, at 22, 84-85; Verizon Initial Cost Brief at 160.

658 Verizon Ex. 109, at 85.

659 *Id.* at 84.

660 *Id.* at 22, 84-86.

661 Verizon Initial Cost Brief at 161; *see also* Verizon Ex. 108, at 31.

662 AT&T/WorldCom Initial Cost Brief at 151.

663 AT&T/WorldCom Initial Cost Brief Proprietary at 153 (confidential version) (citing AT&T Ex. 117P (GTE Network Planning: Planning Analysis Report, Infrastructure Provisioning Guidelines, PAR-074, Revision 1 (March 1997)), at H1-H3 (confidential version)).

664 AT&T/WorldCom Ex. 1, at 13-14; *see also* AT&T/WorldCom Initial Cost Brief at 151-152; AT&T/WorldCom Reply Cost Brief at 66-67.